Purpose: While knee osteoarthritis (KOA) is typically a slowly progressive disorder, it has recently been appreciated that 5–17% of knees progress rapidly (e.g. from normal to end-stage structural damage within 4 years). Unfortunately, little is known about risk factors for this phenotype of OA. Understanding the differences among individuals with rapid KOA, non-rapid KOA, or no KOA may inform prognostic testing, pre-emptive interventions, and increase our understanding of the nature of KOA progression. Therefore, we compared baseline descriptive characteristics among individuals who develop rapid KOA, non-rapid KOA, or no KOA within the Osteoarthritis Initiative.
Methods: In the Osteoarthritis Initiative (OAI) we only studied participants free of any knee OA on their baseline radiographs (Kellgren-Lawrence [KL] < 2). We compared three groups: 1) rapid KOA: at least one knee progressed to end-stage KOA (KL Grade 3 or 4) within 48 months, 2) non-rapid progression: at least one knee increased in radiographic scoring within 48 months (excluding those defined as rapid KOA), and 3) No KOA: no change in KL grade by 48-month follow-up. Self-reported and objective measures (see table) were acquired based on a standard protocol. We first evaluated the distribution of baseline descriptive characteristics among the three groups with Chi-square tests or analyses of variance (with Tukey HSD post-hoc comparisons as needed). Based on the initial analyses we entered baseline descriptive characteristics that may distinguish individuals with rapid KOA (i.e. variables with p values < 0.10 and a sufficient sample size) into a multinomial stepwise logistic regression model to determine if they were associated with rapid KOA as an outcome compared with no KOA or non-rapid KOA.
Results: Individuals with rapid KOA tended to be older and have greater baseline body mass index (BMI) and systolic blood pressure (see Table). After adjusting for evaluated sex, systolic blood pressure, income, presence of comorbidity, static knee malalignment, and use of over-the-counter nonsteroidal anti-inflammatory drugs, only baseline age (odds ratio [OR] = 1.04, 95% confidence interval [CI] = 1.01–1.08; per year) and BMI (OR = 1.10, 95% CI = 1.03–1.17; per kg/m^2) were greater among individuals with rapid KOA compared with those with no KOA. In comparison with individuals with non-rapid KOA, only age was associated with developing rapid KOA (OR = 1.05, 95% CI = 1.01–1.09; per year).
Conclusions: Among individuals with no radiographic KOA, those who develop rapid KOA tended to be older than those with no KOA or non-rapid KOA. Furthermore, individuals with rapid KOA tended to have a higher BMI than those with no KOA. While we often discuss rapid onset of KOA among young individuals with a history of knee injury we must not lose sight that older individuals may also be at risk for rapid KOA.

Table. Baseline Descriptive Characteristics of Individuals with and without Rapid Knee Osteoarthritis (KOA) Progression.

	No KOA (n = 1325) n (%) or mean (SD)	Non-rapid KOA (n = 187) n (%) or mean (SD)	Rapid KOA (n = 54) n (%) or mean (SD)	Univariate Analyses[1] p-value
Females	759 (57.3%)	122 (65.2%)	34 (63.0%)	0.093[2]
Race other than white (n miss = 2)	177 (13.4%)	34 (18.2%)	8 (14.8%)	0.205
Age (years)	59.2 (9.2)	58.0 (8.3)	61.8 (8.6)	0.023[2]
BMI (kg/m^2)	27.1 (4.4)	27.8 (4.5)	28.9 (4.7)	0.002[2]
Abnormal Weight Circumference (n miss = 78)	847 (67.2%)	127 (73.0%)	40 (74.1%)	0.197
Systolic blood pressure (mm Hg)	121.1 (15.9)	118.4 (13.1)	123.1 (14.1)	0.047[2]
Fallen in past 12 mo (n miss = 27)	433 (33.2%)	63 (34.4%)	21 (41.2%)	0.479
Static knee malalignment (Varus or valgus, n miss = 79)[3]	992 (78.9%)	122 (69.7%)	40 (74.1%)	0.020[2]
Socio-economic Status				
No health insurance THAT covers Rx (n miss = 23)	117 (8.9%)	12 (6.6%)	8 (15.7%)	0.126
Income < $50K ($n$ miss = 52)	403 (31.4%)	48 (27.0%)	22 (43.1%)	0.087[2]
Less than a College Degree (n miss = 8)	434 (32.9%)	73 (39.5%)	16 (30.8%)	0.186
Self-reported health assessments				
Frequent knee pain on most days of a month in past year (n miss = 1)	502 (37.9%)	77 (41.2%)	25 (46.3%)	0.344
WOMAC pain Score	2.2 (2.8)	2.1 (2.6)	2.7 (3.0)	0.346
Charlson Comorbidity Score > 0 (n miss = 2)	264 (20.1%)	28 (15.2%)	14 (28.0%)	0.099[2]
SF-12 physical summary score (n miss = 13)	51.5 (7.8)	51.7 (7.6)	50.8 (9.7)	0.773
SF-12 Mental Summary Score (n miss = 13)	53.4 (7.5)	53.8 (7.5)	53.4 (7.7)	0.733
Depression score (CES-D; n miss = 11)	6.0 (6.3)	5.6 (6.1)	6.1 (5.9)	0.708
Physical activity score (PASE score ; n miss = 7)	169 (82)	177 (82)	182 (91)	0.250
Other Joints				
Right hand bony enlargements (n miss = 20)	697 (53.4%)	107 (57.5%)	31 (57.4%)	0.498
Left hand bone enlargements (n miss = 21)	617 (47.3%)	93 (50.0%)	32 (59.3%)	0.191
Any back pain, past 30 days (n miss = 2)	781 (59.0%)	99 (52.9%)	36 (66.7%)	0.134
Doctor diagnosed back OA (n miss = 55)	190 (14.9%)	30 (16.5%)	11 (22.0%)	0.346
Doctor diagnosed hip OA (n miss = 44)	94 (7.3%)	11 (6.0%)	5 (9.8%)	0.624
Doctor diagnosed hand OA (n miss = 44)	215 (16.7%)	21 (11.5%)	9 (17.7%)	0.200
Pharmacological interventions				
Either knee, used meds for pain, past 12 mo (n miss = 2)	571 (43.2%)	86 (46.0%)	27(50%)	0.490
Either knee, injection for arthritis, past 6 m (n miss = 1)	13 (1.0%)	4 (2.1%)	2 (3.7%)	0.094
Take any pain medication today (for any pain)	124 (9.4%)	18 (9.6%)	8 (14.8%)	0.410
OTC NSAIDs for joint pain, past 30 days (n miss = 3)	213 (16.1%)	27 (14.6%)	15 (27.8%)	0.059[2]
Acetaminophen for joint pain, past 30 day (n miss = 2)	112 (8.5%)	12 (6.5%)	7 (13.0%)	0.303
Rx NSAIDs for joint pain, past 30 days (n miss = 1)	56 (4.2%)	9 (4.8%)	1 (1.9%)	0.634
COXIBS for joint pain, past 30 days	86 (6.5%)	9 (4.8%)	4 (7.4%)	0.641
Strong Rx Pain Med for joint pain, past 30 days	29 (2.2%)	3 (1.6%)	0 (0.0%)	0.485

Note. 1) Chi-squares and analyses of variance (with Tukey HSD post-hoc comparisons as needed). 2) Variables that were explored in more advanced analyses. 3) Static malalignment based on a clinical examination with a goniometer. CES-D = Center for Epidemiologic Study Depression Scale Score; PASE = Physical Activity Scale for the Elderly; OTC = over the counter; NSAIDs = nonsteroidal anti-inflammatory drugs; Rx = Prescription; COXIBS = COX-2 selective nonsteroidal anti-inflammatory drugs.

679
EFFECT OF A NOVEL BIOMECHANICAL TREATMENT ON PAIN, FUNCTION AND GAIT PATTERN IN OBESE PATIENTS WITH KNEE OSTEOARTHRITIS

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Purpose: Obesity is strongly linked to knee OA and is considered a risk factor for both incidence and progression. Obese patients with knee OA tend to walk slower, have shorter step length, cadence and single limb support (SLS). Most obese patients fail to comply

with weight-reduction programs to relief pain and improve function.

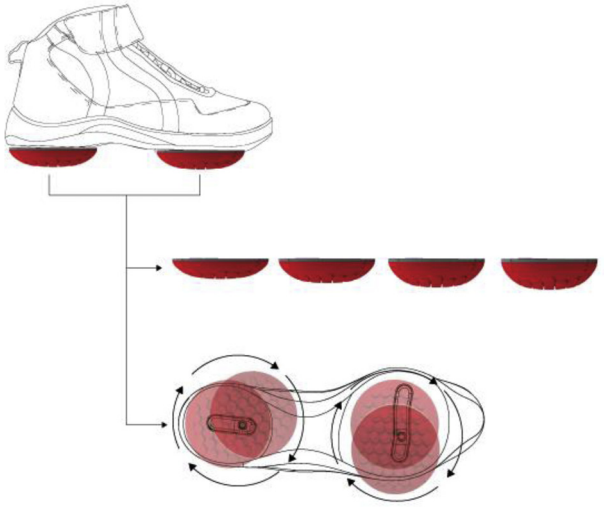
Several biomechanical treatments for knee OA have emerged with the goal of reducing pain, improving function and halting disease progression. These treatments aim to unload the diseased articular surface by using wedged insoles, foot orthoses, unique shoes or valgus braces. The aim of this study was to examine the effect of a biomechanical, home-based, gait training device on gait patterns of obese patients suffering from knee OA.

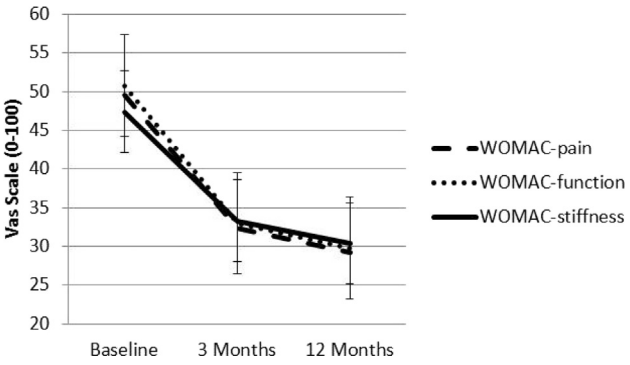
Methods: This was a retrospective analysis of 105 (32 males and 73 females) obese patients (BMI >30 kg/m^2) with knee OA. All patients underwent a computerized gait test to characterize spatio-temporal parameters and were asked to complete The Western Ontario and McMaster Osteoarthritis Index (WOMAC) questionnaire and SF-36 Health Survey. Patients were fitted with the biomechanical gait training device and received home-based exercise program. Patients returned to the clinic for additional assessments of gait patterns and clinical symptoms following 3 and 12 months of therapy. One-way repeated measure ANOVA was applied to determine significant changes over time, p-value was set to $p < 0.05$.

Results: A significant reduction in pain, stiffness and functional limitation was seen after 3 months of therapy with an additional improvement following 12 months of therapy. Pain decreased by 34.7% following 3 months of therapy and further decreased by an additional 11.0%. Functional limitation decreased by 35.0% following 3 months of therapy and further decreased by an additional 9.7%. Both Physical Scale and Mental Scale of the SF-36 increased significantly following 3 months of therapy and further increased following 12 months of therapy.

Significant improvements in gait pattern were found in all parameters after 3 months of therapy with an additional improvement following 12 months of therapy. Gait velocity increased by 11.8% following 3 months of therapy and further improved by an additional 4.3%. SLS of the more symptomatic knee increase by 2.5% following 3 months of therapy and further improved by an additional 1.1%.

Conclusions: Obese patients with knee OA complied with a home-based exercise program using a biomechanical gait training device. Patients demonstrated a significant improvement in gait patterns and clinical symptoms mainly after 3 months of therapy with an additional improvement after 12 months of therapy. This therapy may help obese patient with knee OA to become active and persist with an exercise program that will lead them to relieved pain and improved function.





680
INCIDENCE OF TOTAL KNEE AND HIP REPLACEMENT DUE TO OSTEOARTHRITIS IN RELATION TO CIRCULATING SEX STEROID HORMONE CONCENTRATIONS IN WOMEN

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Purpose: The increase in prevalence of osteoarthritis (OA) in post-menopausal women suggests that changes in either circulating sex steroid concentrations or tissue response to sex steroids may have a role in the pathogenesis of OA. The aim of this study was to examine whether circulating sex steroid concentrations were associated with the incidence of total knee and hip replacement for OA.

Methods: 2,621 women with circulating sex steroid concentrations measured in blood samples drawn at recruitment (1990-1994) were selected from the Melbourne Collaborative Cohort Study (MCCS). The incidence of total knee and hip replacement for OA during 2001-2011 was determined by linking MCCS records to the Australian Orthopaedic Association National Joint Replacement Registry.

Results: 115 women had total knee replacement and 99 had total hip replacement due to OA. Greater log estradiol concentration was associated with a lower incidence of knee replacement (hazard ratio (HR) 0.70, 95% CI 0.50-0.96) and greater log androstenedione concentration was associated with a lower incidence of hip replacement (HR 0.70, 95% CI 0.52-0.93). In contrast, greater log sex hormone binding globulin (SHBG) concentration was associated with greater incidence of hip replacement (HR 1.70, 95% CI 1.05-2.77).

Conclusions: Lower estradiol concentration is a risk factor for knee OA; lower androstenedione concentration and higher SHBG concentration are risk factors for hip OA in women. The findings suggest a role for circulating sex steroids in the pathogenesis of OA and that modifying these steroid concentrations may provide potential strategies for the prevention and treatment of large joint OA.

681
INVESTIGATION OF THE RELATIONSHIPS BETWEEN OSTEOARTHRITIS AND OSTEOPOROSIS USING DUAL ENERGY X-RAY ABSORPTIOMETRY IMAGES

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Purpose: Osteoarthritis (OA) and osteoporosis (OP) are diseases affecting joints and bones. OA is generally assessed using radiographs and OP by Dual Energy X-ray Absorptiometry (DXA) scans however OA can also be assessed on DXA images using Kellgren Lawrence Grading (KLG). OP is a well understood disease, with effective treatments (e.g. bisphosphonates) that prevent or delay fracture. However we do not fully understand OA and there are no effective disease modifying drugs.